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the Lineman

RURAL ELECTRIFICATION ADMINISTRATION - U. S. DEPARTMENT OF AGRICULTURE



Electric Shock

The Lineman's Greatest Hazard

A tree fell on a single phase line and broke both primary and neutral. The pole where the break occurred was a double dead-end with a 3-wire secondary taking off at approximately right angles (see sketch).

A lineman and his helper were sent to repair the line. They untangled the conductor from the tree. The damaged section was cut out and new conductor spliced in. The double dead-end pole was equipped with a fused cut-out type E.S., Style 1019420, 7500/12,500 volt, 5 amp. It had been fused with a 2 amp fuse. From the ground it was apparent that the fuse was blown and the load side was dead.

The lineman decided to pull up the phase which had been repaired and dead-end it. He also decided to leave the source side of the double dead-end hot. Since the fuse was blown, he decided that this was enough protection as long as he did not contact the hot source side.

He started to climb the pole. On the way up the pole, he instructed his helper to obtain some tools from the truck. The helper went to get the tools and did not see what happened. He heard an arc and the thud of a body striking the ground. Before fastening his safety strap, the lineman had received an electric shock and had fallen from the pole. There was a slight electrical burn on one hand. The extent of the burn did not indicate he had received full primary voltage.

Heavy rain was falling at the time of the accident. It is assumed that enclosed cut-out being wet throughout permitted enough leakage current over the cut-out to energize the jumper attached to the dead side with enough current to cause a slight burn and cause the injured to lose control and fall.

The lineman was at no time unconscious. He apparently suffered greater injury from striking the ground on his back after falling approximately 28 feet than he did from the electric shock.

He was removed to the hospital in a very serious condition.

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Nebraska Digs Out



Maintaining electrical service in many Western States has been difficult this winter. The snow scene above was sent in by Nebraska's Safety and Job Training instructor, A. L. Chantry.

The picture was taken near a new substation of the Cornhusker Rural Public Power District of Columbus, Neb. The men are digging four number 1/0 aluminum conductors out of snow drifts ranging from four to eight feet deep.

No serious accidents reported to REA from the snow-bound west can be attributed to the unfavorable weather conditions which have prevailed since November 1948. This speaks well for the work of the State Safety and Job Training instructors in that area. The interest and cooperation of the system managers have also been contributing factors in attaining this record.

Wanted: "Hard Luck Harry" Ideas

George Perkins, who draws "Hard Luck Harry" cartoons, would like ideas from linemen to use in cartoons. You will receive credit in The Lineman for any suggestion that you make which can be used in one of these cartoons. Send your suggestions to the Editor of The Lineman, U. S. Department of Agriculture, REA, Washington 25, D. C.

The Lineman is published monthly in the interest of safety for REA-financed systems.

Ralph A. C. Hill, Editor

Frank H. LaMaster, Associate Editor

New Instructor



G. H. Mowers Was selected to instruct in the North Dakota Safety and Job Training program. His headquarters will be at the North Dakota State School of Science at Wahpeton.

Mowers attended an intensive training course at the North Dakota State School of Science before starting his work with the co-op linemen.

Tribute To The Rural Lineman

Editorial

When we wrote the following in our Christmas greetings to the lineman of rural America last december, we did not realize just how deep some of the snow drifts would be this winter:

He's plowing through a snow drift
at an early morning hour
So you can have your breakfast,
that's cooked on co-op power.
In wind or rain, cold or heat,
he takes 'em as they come,
With nature often at her worst,
his tough job must be done.

Operating and maintaining the rural lines has been a problem from the middle west to the Rocky Mountains. The blizzards which swept the western plains and the sleet and ice which covered parts of the middle west made roads impassable, buried substations and did all sorts of damage to the lines.

In portions of Illinois, the trees were so coated with ice that many of the limbs broke and tore down lines. Other limbs loaded to the breaking point broke from the vibration caused by linemen attempting to climb the tree.

Everywhere poles were coated with a layer of ice. These poles had to be climbed by men who, in their earnest desire to restore service, were working from 16 to 19 hours per day. One manager stated that his crews averaged 19 hours per day for a ten-day period.

Not only were working conditions perilous but the roads over which these men had to travel were slick and treacherous. Working long hours with little rest dulls the senses and reflexes of the individual. Under these conditions, accidents are more likely to happen. To the credit of these crews is the fact that, so far, no serious accidents have resulted from these abnormal weather conditions.

"Lights out" or "lines down" has always been a challenge to the men who maintain electrical service. This challenge has been met by the co-op linemen during this emergency by the giving of their last ounce of strength and know how. These men have upheld the fine tradition of service above self and are indeed a credit to their craft.

The Lineman and we, are certain, the members whom you have served so faithfully, salute you, the rural linemen of America who have performed so unselfishly in this emergency.

DISCONNECTING SWITCHES

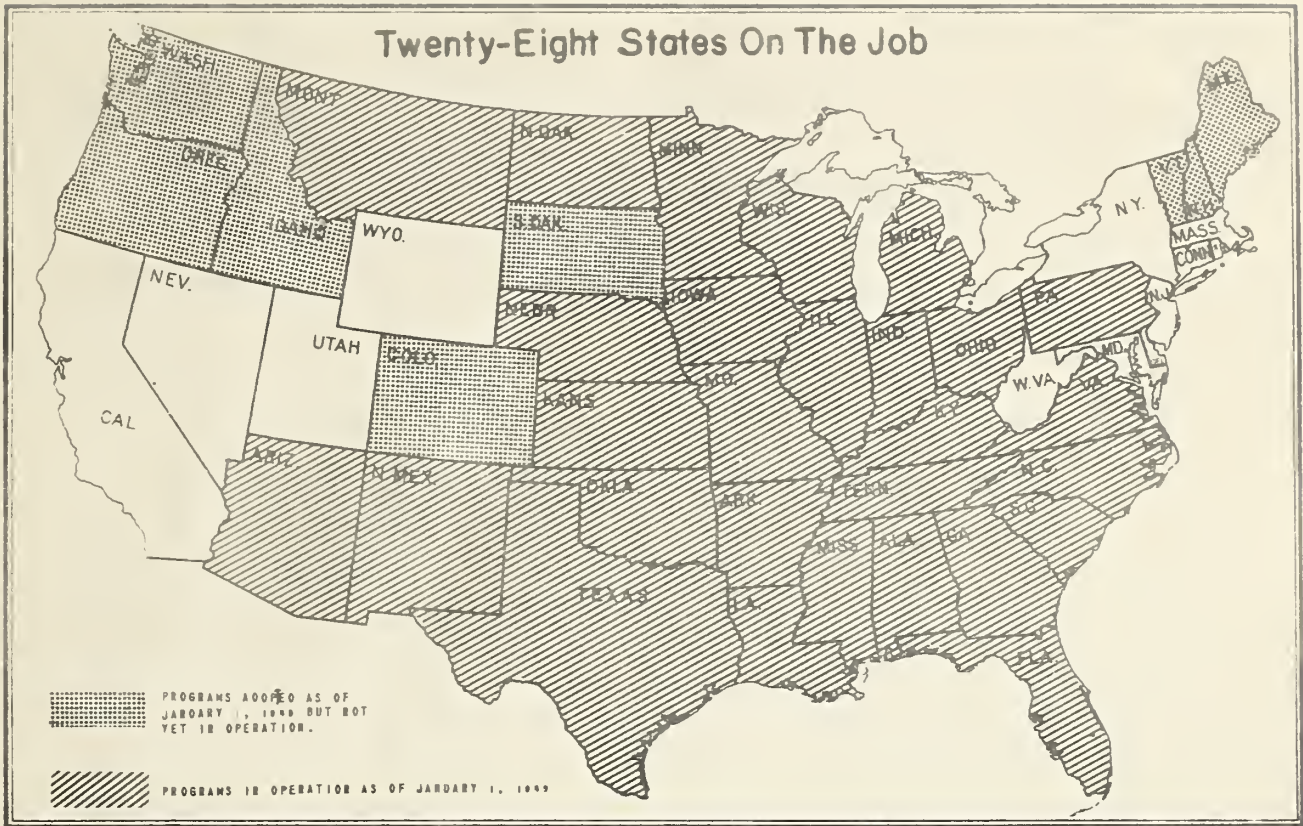
General Precautions in Opening and Closing

1. Be sure all circuit and operating conditions are correct.
2. Wear rubber gloves, goggles, and any other protective equipment required by company rules.
3. Check the markings to be sure you are operating the right switch.
4. Use only an approved insulated "hook" stick in sound condition.
5. Check the operating mechanism of gang-operated switches.
6. Get in a safe position to operate the switch. Avoid electrical hazard and physical strain. Be sure of your footing.



SAFETY INSTRUCTION CARD No. 611
National Safety Council PRINTED IN U.S.A.

Twenty-Eight States On The Job



As of January 1, 1949, 28 states were operating Safety and Job training programs with one or more full time instructors on the job. (See map) Five of these states got their programs underway last year. They are Florida, New Mexico, Arizona, Montana and North

Dakota.

Eight more states -- Washington, Oregon, Idaho, Colorado, South Dakota, Maine, Vermont, are now organizing ways and means for putting the program in operation.

Safe To Open Neutral?

The question often arises as to the voltage hazard which a lineman would encounter in opening up the neutral conductor.

Technical Standards Division engineers have done some experimental work along this line and have furnished the following information:

The hazard involved in opening the neutral conductor of an energized circuit depends considerably on the resistance between the disconnected portion of the neutral conductor and the ground. This resistance has been measured on various systems and found to be between 1 and 25 ohms depending on local grounding conditions.

If the neutral conductor is opened, the voltage appearing across the ends of the of the conductor will be approximately equal to the product of the total unbalanced current (phase current in a single-phase circuit) and the resistance between the neutral and ground. On well grounded lightly loaded lines this voltage will be

very small, but under short circuit conditions it may amount to several hundred volts. On poorly grounded heavily loaded lines, the voltage may be high enough to be dangerous.

In a normal situation, where the load on a single-phase line beyond the point where the neutral is opened may amount to 20Kva and the resistance of the neutral to ground may be 3 ohms, the voltage across the opened neutral would be about 9 volts. However, if a short circuit developed on the line with a short circuit current in the order of 200 amperes, the voltage would be about 600 volts. Under adverse conditions with the resistance between the neutral and ground in the order of 25 ohms and a load of about 50 Kva, the voltage across the ends of the open neutral conductor would be about 175 volts. Either of these conditions would obviously be dangerous

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deRe edDitEr

I was thinking that if there was some way to tell when a line was dead maybe I would get to work on one sooner. Ben says dead lines that are hot kill lineman all the time. Just like a fella I read about the other day who opened up the wrong jumper on a junction pole and was killed a couple of miles away on the tap line which he thought he had kilt. Don't you think that a fella like me who has been around a year now ought to get to do a little light hot work? Let me know right away because I heard Ben tell the manager the other day that he'd get me on that brush cutting job the first of the month and the blackberry briars are pretty thick down through there. Yours truly, Hi Tension

P. S. After I get to be a lineman, how long ought it take to be a forman?

Dear mr. "Hi Tension":

It will not be necessary for you to invent anything to tell when a line is dead. All you have to do is apply these two simple test. Test No. 1 - Is it wound on a reel in the warehouse? If so, it's dead. Test No. 2 - Does the part you think is dead have a protective ground on each side of it? If it does, it is dead. Any other line is hot.

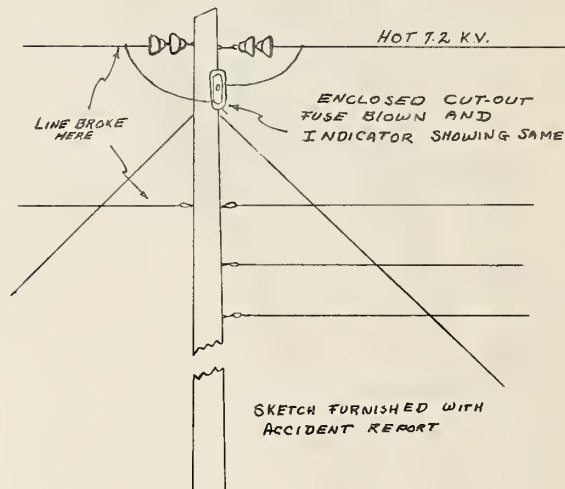
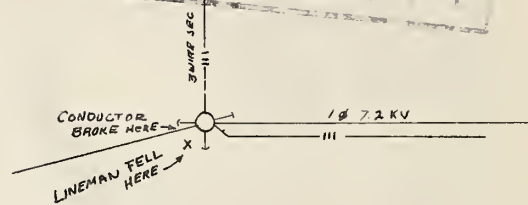
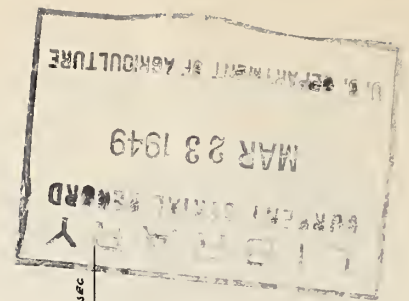
With your experience, the only hot work we would recommend for you would be firing the furnace this winter. Make it light or heavy according to the weather.

It is our suggestion that you discuss how long it will take you to be a foreman with Ben. Yours truly, The Editor

SAFE TO OPEN (continued)

Discussions Points on Grounding:

1. The proper procedure to install a ground wire or protective ground is first to attach it to the ground rod or other device to be used to make connection with the earth.
The second step is to connect this ground wire or protective ground to the equipment or part to be grounded.
2. What could happen if the above procedure was reversed?
3. In removing a protective ground or other ground wire, it should first be disconnected from the ground rod or other attachment which is in contact with the earth. Under certain conditions why would it be hazardous to remove the ground connection first?
4. One end of the primary coil of a single bushing transformer is attached to the transformer case. If the case ground was removed from an energized single bushing transformer, would the case be hot?



ELECTRIC SHOCK (continued)

Discussion Points

1. How would you prevent an accident such as this?
 - a. By the use of rubber gloves.
 - b. By de-energizing the cut-out completely by removing the source side jumper to the cut-out.
 - c. By killing the line on the source side of the pole.
2. If you chose a. or b., how close would you be to the hot phase during the dead-ending of the damaged line? Would it be possible while doing this work to make contact with or fall into the hot phase?
3. If you chose c. would you be absolutely safe without a protective ground on both the source and load side of the double dead-end?
4. What effect does wet and stormy weather have on live line work?